Appendix A

- GPS coordinates for aquatic plant surveys conducted on Long Lake near Saxeville, Waushara County, WI.

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude	Site	Latitude	Longitude
1	44.2168	-89.1373	50	44.2174	-89.1345
2	44.2165	-89.1373	51	44.2171	-89.1345
3	44.2178	-89.1368	52	44.2168	-89.1345
4	44.2175	-89.1368	53	44.2148	-89.1345
5	44.2171	-89.1368	54	44.2144	-89.1345
6	44.2168	-89.1368	55	44.2141	-89.1345
7	44.2185	-89.1363	56	44.2138	-89.1345
8	44.2181	-89.1363	57	44.2135	-89.1345
9	44.2178	-89.1363	58	44.2131	-89.1345
10	44.2175	-89.1363	59	44.2128	-89.1345
11	44.2171	-89.1363	60	44.2125	-89.1345
12	44.2168	-89.1363	61	44.2188	-89.1340
13	44.2188	-89.1358	62	44.2184	-89.1340
14	44.2185	-89.1358	63	44.2181	-89.1340
15	44.2181	-89.1358	64	44.2178	-89.1340
16	44.2178	-89.1359	65	44.2174	-89.1340
17	44.2175	-89.1359	66	44.2171	-89.1340
18	44.2171	-89.1359	67	44.2168	-89.1340
19	44.2145	-89.1359	68	44.2164	-89.1340
20	44.2141	-89.1359	69	44.2161	-89.1340
21	44.2138	-89.1359	70	44.2154	-89.1340
22	44.2135	-89.1359	71	44.2151	-89.1340
23	44.2188	-89.1354	72	44.2148	-89.1340
24	44.2185	-89.1354	73	44.2144	-89.1340
25	44.2181	-89.1354	74	44.2141	-89.1341
26	44.2178	-89.1354	75	44.2138	-89.1341
27	44.2175	-89.1354	76	44.2134	-89.1341
28	44.2171	-89.1354	77	44.2131	-89.1341
29	44.2148	-89.1354	78	44.2128	-89.1341
30	44.2145	-89.1354	79	44.2124	-89.1341
31	44.2141	-89.1354	80	44.2188	-89.1335
32	44.2138	-89.1354	81	44.2184	-89.1335
33	44.2135	-89.1355	82	44.2181	-89.1335
34	44.2131	-89.1355	83	44.2178	-89.1335
35	44.2188	-89.1349	84	44.2174	-89.1335
36	44.2185	-89.1349	85	44.2171	-89.1335
37	44.2181	-89.1349	86	44.2168	-89.1336
38	44.2178	-89.1349	87	44.2164	-89.1336
39	44.2175	-89.1349	88	44.2161	-89.1336
40	44.2171	-89.1349	89	44.2158	-89.1336
41	44.2141	-89.1350	90	44.2154	-89.1336
42	44.2138	-89.1350	91	44.2151	-89.1336
43	44.2135	-89.1350	92	44.2148	-89.1336
44	44.2131	-89.1350	93	44.2144	-89.1336
45	44.2128	-89.1350	94	44.2141	-89.1336
46	44.2188	-89.1344	95	44.2138	-89.1336
47	44.2184	-89.1345	96	44.2134	-89.1336
48	44.2181	-89.1345	97	44.2131	-89.1336
49	44.2178	-89.1345	98	44.2128	-89.1336

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude	Site	Latitude	Longitude
99	44.2124	-89.1336	148	44.2171	-89.1322
100	44.2121	-89.1336	149	44.2168	-89.1322
101	44.2188	-89.1331	150	44.2164	-89.1322
102	44.2184	-89.1331	151	44.2161	-89.1322
103	44.2181	-89.1331	152	44.2158	-89.1322
104	44.2178	-89.1331	153	44.2154	-89.1322
105	44.2174	-89.1331	154	44.2151	-89.1322
106	44.2171	-89.1331	155	44.2148	-89.1322
107	44.2168	-89.1331	156	44.2144	-89.1322
108	44.2164	-89.1331	157	44.2141	-89.1322
109	44.2161	-89.1331	158	44.2138	-89.1322
110	44.2158	-89.1331	159	44.2134	-89.1322
111	44.2154	-89.1331	160	44.2131	-89.1322
112	44.2151	-89.1331	161	44.2128	-89.1322
113	44.2148	-89.1331	162	44.2124	-89.1322
114	44.2144	-89.1331	163	44.2121	-89.1322
115	44.2141	-89.1331	164	44.2188	-89.1317
116	44.2138	-89.1331	165	44.2184	-89.1317
117	44.2134	-89.1331	166	44.2181	-89.1317
118	44.2131	-89.1331	167	44.2178	-89.1317
119	44.2128	-89.1331	168	44.2174	-89.1317
120	44.2124	-89.1332	169	44.2171	-89.1317
121	44.2121	-89.1332	170	44.2168	-89.1317
122	44.2188	-89.1326	171	44.2164	-89.1317
123	44.2184	-89.1326	172	44.2161	-89.1317
124	44.2181	-89.1326	173	44.2158	-89.1317
125	44.2178	-89.1326	174	44.2154	-89.1317
126	44.2174	-89.1326	175	44.2151	-89.1317
127	44.2171	-89.1326	176	44.2148	-89.1317
128	44.2168	-89.1326	177	44.2144	-89.1317
129	44.2164	-89.1326	178	44.2141	-89.1317
130	44.2161	-89.1326	179	44.2138	-89.1317
131	44.2158	-89.1326	180	44.2134	-89.1317
132	44.2154	-89.1326	181	44.2131	-89.1318
133	44.2151	-89.1326	182	44.2128	-89.1318
134	44.2148	-89.1327	183	44.2124	-89.1318
135	44.2144	-89.1327	184	44.2121	-89.1318
136	44.2141	-89.1327	185	44.2188	-89.1312
137	44.2138	-89.1327	186	44.2184	-89.1312
138	44.2134	-89.1327	187	44.2181	-89.1312
139	44.2131	-89.1327	188	44.2178	-89.1312
140	44.2128	-89.1327	189	44.2174	-89.1312
141	44.2124	-89.1327	190	44.2171	-89.1312
142	44.2121	-89.1327	191	44.2168	-89.1312
143	44.2188	-89.1321	192	44.2164	-89.1312
144	44.2184	-89.1321	193	44.2161	-89.1312
145	44.2181	-89.1321	194	44.2158	-89.1312
146	44.2178	-89.1321	195	44.2154	-89.1313
147	44.2174	-89.1322	196	44.2151	-89.1313

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude
197	44.2148	-89.1313
198	44.2144	-89.1313
199	44.2141	-89.1313
200	44.2138	-89.1313
201	44.2134	-89.1313
202	44.2131	-89.1313
203	44.2128	-89.1313
204	44.2124	-89.1313
205	44.2121	-89.1313
206	44.2188	-89.1307
207	44.2184	-89.1307
208	44.2181	-89.1308
209	44.2178	-89.1308
210	44.2174	-89.1308
211	44.2171	-89.1308
212	44.2168	-89.1308
213	44.2164	-89.1308
214	44.2161	-89.1308
215	44.2158	-89.1308
216	44.2154	-89.1308
217	44.2151	-89.1308
218	44.2148	-89.1308
219	44.2144	-89.1308
220	44.2141	-89.1308
221	44.2138	-89.1308
222	44.2134	-89.1308
223	44.2131	-89.1308
224	44.2128	-89.1308
225	44.2124	-89.1308
226	44.2121	-89.1308
227	44.2187	-89.1303
228	44.2184	-89.1303
229	44.2181	-89.1303
230	44.2177	-89.1303
231	44.2174	-89.1303
232	44.2171	-89.1303
233	44.2167	-89.1303
234	44.2164	-89.1303
235	44.2161	-89.1303
236	44.2158	-89.1303
237	44.2154	-89.1303
238	44.2151	-89.1303
239	44.2148	-89.1303
240	44.2144	-89.1303
241	44.2141	-89.1303
242	44.2138	-89.1304
243	44.2134	-89.1304
244	44.2131	-89.1304
245	44.2128	-89.1304
246	44.2124	-89.1304
247	44.2121	-89.1304
248	44.2187	-89.1298
249	44.2184	-89.1298
250	44.2181	-89.1298
251	44.2177	-89.1298
252	44.2174	-89.1298
253	44.2171	-89.1298
254	44.2167	-89.1298
255	44.2164	-89.1299
256	44.2161	-89.1299
257	44.2157	-89.1299
258	44.2154	-89.1299
259	44.2151	-89.1299
260	44.2147	-89.1299
261	44.2144	-89.1299
262	44.2141	-89.1299
263	44.2137	-89.1299
264	44.2134	-89.1299
265	44.2131	-89.1299
266	44.2127	-89.1299
267	44.2124	-89.1299
268	44.2121	-89.1299
269	44.2118	-89.1299
270	44.2187	-89.1294
271	44.2184	-89.1294
272	44.2181	-89.1294
273	44.2177	-89.1294
274	44.2174	-89.1294
275	44.2171	-89.1294
276	44.2167	-89.1294
277	44.2164	-89.1294
278	44.2161	-89.1294
279	44.2157	-89.1294
280	44.2154	-89.1294
281	44.2151	-89.1294
282	44.2147	-89.1294
283	44.2144	-89.1294
284	44.2141	-89.1294
285	44.2137	-89.1294
286	44.2134	-89.1294
287	44.2131	-89.1294
288	44.2127	-89.1294
289	44.2124	-89.1294
290	44.2121	-89.1295
291	44.2117	-89.1295
292	44.2187	-89.1289
293	44.2184	-89.1289
294	44.2181	-89.1289

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude	Site	Latitude	Longitude
295	44.2177	-89.1289	343	44.2161	-89.1280
296	44.2174	-89.1289	344	44.2157	-89.1280
297	44.2171	-89.1289	345	44.2154	-89.1280
298	44.2167	-89.1289	346	44.2151	-89.1280
299	44.2164	-89.1289	347	44.2147	-89.1280
300	44.2161	-89.1289	348	44.2144	-89.1280
301	44.2157	-89.1289	349	44.2141	-89.1280
302	44.2154	-89.1289	350	44.2137	-89.1280
303	44.2151	-89.1289	351	44.2134	-89.1280
304	44.2147	-89.1289	352	44.2131	-89.1280
305	44.2144	-89.1290	353	44.2127	-89.1281
306	44.2141	-89.1290	354	44.2194	-89.1275
307	44.2137	-89.1290	355	44.2191	-89.1275
308	44.2134	-89.1290	356	44.2187	-89.1275
309	44.2131	-89.1290	357	44.2184	-89.1275
310	44.2127	-89.1290	358	44.2181	-89.1275
311	44.2124	-89.1290	359	44.2177	-89.1275
312	44.2121	-89.1290	360	44.2174	-89.1275
313	44.2187	-89.1284	361	44.2171	-89.1275
314	44.2184	-89.1284	362	44.2167	-89.1275
315	44.2181	-89.1284	363	44.2164	-89.1275
316	44.2177	-89.1284	364	44.2161	-89.1275
317	44.2174	-89.1284	365	44.2157	-89.1275
318	44.2171	-89.1285	366	44.2154	-89.1275
319	44.2167	-89.1285	367	44.2151	-89.1276
320	44.2164	-89.1285	368	44.2147	-89.1276
321	44.2161	-89.1285	369	44.2144	-89.1276
322	44.2157	-89.1285	370	44.2141	-89.1276
323	44.2154	-89.1285	371	44.2137	-89.1276
324	44.2151	-89.1285	372	44.2134	-89.1276
325	44.2147	-89.1285	373	44.2131	-89.1276
326	44.2144	-89.1285	374	44.2194	-89.1270
327	44.2141	-89.1285	375	44.2191	-89.1270
328	44.2137	-89.1285	376	44.2187	-89.1270
329	44.2134	-89.1285	377	44.2184	-89.1270
330	44.2131	-89.1285	378	44.2181	-89.1270
331	44.2127	-89.1285	379	44.2177	-89.1271
332	44.2124	-89.1285	380	44.2174	-89.1271
333	44.2121	-89.1285	381	44.2171	-89.1271
334	44.2191	-89.1280	382	44.2167	-89.1271
335	44.2187	-89.1280	383	44.2164	-89.1271
336	44.2184	-89.1280	384	44.2161	-89.1271
337	44.2181	-89.1280	385	44.2157	-89.1271
338	44.2177	-89.1280	386	44.2154	-89.1271
339	44.2174	-89.1280	387	44.2151	-89.1271
340	44.2171	-89.1280	388	44.2147	-89.1271
341	44.2167	-89.1280	389	44.2144	-89.1271
342	44.2164	-89.1280	390	44.2141	-89.1271

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude
391	44.2137	-89.1271
392	44.2134	-89.1271
393	44.2194	-89.1266
394	44.2191	-89.1266
395	44.2187	-89.1266
396	44.2184	-89.1266
397	44.2181	-89.1266
398	44.2177	-89.1266
399	44.2174	-89.1266
400	44.2171	-89.1266
401	44.2167	-89.1266
402	44.2164	-89.1266
403	44.2161	-89.1266
404	44.2157	-89.1266
405	44.2154	-89.1266
406	44.2151	-89.1266
407	44.2147	-89.1266
408	44.2144	-89.1266
409	44.2141	-89.1266
410	44.2137	-89.1266
411	44.2190	-89.1261
412	44.2187	-89.1261
413	44.2184	-89.1261
414	44.2181	-89.1261
415	44.2177	-89.1261
416	44.2174	-89.1261
417	44.2171	-89.1261
418	44.2167	-89.1261
419	44.2164	-89.1261
420	44.2161	-89.1262
421	44.2157	-89.1262
422	44.2154	-89.1262
423	44.2151	-89.1262
424	44.2147	-89.1262
425	44.2144	-89.1262
426	44.2141	-89.1262
427	44.2137	-89.1262
428	44.2190	-89.1256
429	44.2187	-89.1256
430	44.2184	-89.1257
431	44.2180	-89.1257
432	44.2177	-89.1257
433	44.2174	-89.1257
434	44.2170	-89.1257
435	44.2167	-89.1257
436	44.2164	-89.1257
437	44.2160	-89.1257
438	44.2157	-89.1257
439	44.2154	-89.1257
440	44.2150	-89.1257
441	44.2147	-89.1257
442	44.2144	-89.1257
443	44.2140	-89.1257
444	44.2187	-89.1252
445	44.2184	-89.1252
446	44.2180	-89.1252
447	44.2177	-89.1252
448	44.2174	-89.1252
449	44.2170	-89.1252
450	44.2167	-89.1252
451	44.2164	-89.1252
452	44.2160	-89.1252
453	44.2157	-89.1252
454	44.2154	-89.1252
455	44.2150	-89.1252
456	44.2147	-89.1252
457	44.2184	-89.1247
458	44.2180	-89.1247
459	44.2177	-89.1247
460	44.2174	-89.1247
461	44.2170	-89.1247
462	44.2167	-89.1248
463	44.2164	-89.1248
464	44.2160	-89.1248
465	44.2157	-89.1248
466	44.2154	-89.1248
467	44.2150	-89.1248
468	44.2180	-89.1243
469	44.2177	-89.1243
470	44.2174	-89.1243
471	44.2170	-89.1243
472	44.2167	-89.1243
473	44.2164	-89.1243
474	44.2160	-89.1243
475	44.2157	-89.1243
476	44.2154	-89.1243
477	44.2177	-89.1238
478	44.2174	-89.1238
479	44.2170	-89.1238
480	44.2167	-89.1238
481	44.2164	-89.1238
482	44.2160	-89.1238
483	44.2157	-89.1238
484	44.2154	-89.1238
485	44.2177	-89.1233
486	44.2174	-89.1234
487	44.2170	-89.1234
488	44.2167	-89.1234

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude
489	44.2164	-89.1234
490	44.2160	-89.1234
491	44.2157	-89.1234
492	44.2174	-89.1229
493	44.2170	-89.1229
494	44.2167	-89.1229
495	44.2164	-89.1229
496	44.2160	-89.1229
497	44.2157	-89.1229
498	44.2174	-89.1224
499	44.2170	-89.1224
500	44.2167	-89.1224
501	44.2164	-89.1224
502	44.2160	-89.1224
503	44.2170	-89.1220
504	44.2167	-89.1220
505	44.2164	-89.1220
506	44.2160	-89.1220
507	44.2170	-89.1215
508	44.2167	-89.1215
509	44.2163	-89.1215
510	44.2160	-89.1215
511	44.2167	-89.1210
512	44.2163	-89.1211
513	44.2160	-89.1211
514	44.2167	-89.1206
515	44.2163	-89.1206
516	44.2160	-89.1206
517	44.2157	-89.1206
518	44.2153	-89.1206
519	44.2167	-89.1201
520	44.2163	-89.1201
521	44.2160	-89.1201
522	44.2157	-89.1201
523	44.2153	-89.1201
524	44.2177	-89.1196
525	44.2173	-89.1196
526	44.2167	-89.1197
527	44.2163	-89.1197
528	44.2160	-89.1197
529	44.2157	-89.1197
530	44.2153	-89.1197
531	44.2177	-89.1192
532	44.2173	-89.1192
533	44.2170	-89.1192
534	44.2167	-89.1192
535	44.2163	-89.1192
536	44.2160	-89.1192
537	44.2157	-89.1192
538	44.2153	-89.1192
539	44.2177	-89.1187
540	44.2173	-89.1187
541	44.2170	-89.1187
542	44.2167	-89.1187
543	44.2163	-89.1187
544	44.2160	-89.1187
545	44.2157	-89.1187
546	44.2153	-89.1188
547	44.2180	-89.1182
548	44.2177	-89.1183
549	44.2173	-89.1183
550	44.2170	-89.1183
551	44.2167	-89.1183
552	44.2163	-89.1183
553	44.2160	-89.1183
554	44.2157	-89.1183
555	44.2153	-89.1183
556	44.2150	-89.1183
557	44.2147	-89.1183
558	44.2183	-89.1178
559	44.2180	-89.1178
560	44.2177	-89.1178
561	44.2173	-89.1178
562	44.2170	-89.1178
563	44.2167	-89.1178
564	44.2163	-89.1178
565	44.2160	-89.1178
566	44.2157	-89.1178
567	44.2153	-89.1178
568	44.2150	-89.1178
569	44.2147	-89.1178
570	44.2143	-89.1178
571	44.2186	-89.1173
572	44.2183	-89.1173
573	44.2180	-89.1173
574	44.2176	-89.1173
575	44.2173	-89.1173
576	44.2170	-89.1173
577	44.2167	-89.1173
578	44.2163	-89.1173
579	44.2160	-89.1174
580	44.2157	-89.1174
581	44.2153	-89.1174
582	44.2150	-89.1174
583	44.2147	-89.1174
584	44.2143	-89.1174
585	44.2186	-89.1168
586	44.2183	-89.1169

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude
587	44.2180	-89.1169
588	44.2176	-89.1169
589	44.2173	-89.1169
590	44.2170	-89.1169
591	44.2166	-89.1169
592	44.2163	-89.1169
593	44.2160	-89.1169
594	44.2156	-89.1169
595	44.2153	-89.1169
596	44.2150	-89.1169
597	44.2146	-89.1169
598	44.2143	-89.1169
599	44.2186	-89.1164
600	44.2183	-89.1164
601	44.2180	-89.1164
602	44.2176	-89.1164
603	44.2173	-89.1164
604	44.2170	-89.1164
605	44.2166	-89.1164
606	44.2163	-89.1164
607	44.2160	-89.1164
608	44.2156	-89.1164
609	44.2153	-89.1164
610	44.2150	-89.1164
611	44.2146	-89.1164
612	44.2143	-89.1164
613	44.2186	-89.1159
614	44.2183	-89.1159
615	44.2180	-89.1159
616	44.2176	-89.1159
617	44.2173	-89.1159
618	44.2170	-89.1159
619	44.2166	-89.1160
620	44.2163	-89.1160
621	44.2160	-89.1160
622	44.2156	-89.1160
623	44.2153	-89.1160
624	44.2150	-89.1160
625	44.2146	-89.1160
626	44.2186	-89.1155
627	44.2183	-89.1155
628	44.2180	-89.1155
629	44.2176	-89.1155
630	44.2173	-89.1155
631	44.2170	-89.1155
632	44.2166	-89.1155
633	44.2163	-89.1155
634	44.2160	-89.1155
635	44.2156	-89.1155
636	44.2153	-89.1155
637	44.2150	-89.1155
638	44.2186	-89.1150
639	44.2183	-89.1150
640	44.2180	-89.1150
641	44.2176	-89.1150
642	44.2173	-89.1150
643	44.2170	-89.1150
644	44.2166	-89.1150
645	44.2163	-89.1150
646	44.2160	-89.1150
647	44.2156	-89.1150
648	44.2153	-89.1150
649	44.2186	-89.1145
650	44.2183	-89.1145
651	44.2180	-89.1145
652	44.2176	-89.1145
653	44.2173	-89.1146
654	44.2170	-89.1146
655	44.2166	-89.1146
656	44.2163	-89.1146
657	44.2160	-89.1146
658	44.2156	-89.1146
659	44.2190	-89.1141
660	44.2186	-89.1141
661	44.2183	-89.1141
662	44.2180	-89.1141
663	44.2176	-89.1141
664	44.2173	-89.1141
665	44.2170	-89.1141
666	44.2166	-89.1141
667	44.2163	-89.1141
668	44.2160	-89.1141
669	44.2156	-89.1141
670	44.2193	-89.1136
671	44.2190	-89.1136
672	44.2186	-89.1136
673	44.2183	-89.1136
674	44.2180	-89.1136
675	44.2176	-89.1136
676	44.2173	-89.1136
677	44.2170	-89.1136
678	44.2166	-89.1136
679	44.2163	-89.1136
680	44.2160	-89.1136
681	44.2193	-89.1131
682	44.2189	-89.1131
683	44.2186	-89.1131
684	44.2183	-89.1131

GPS coordinates for aquatic plant surveys on Long Lake, Waushara County, WI.

Site	Latitude	Longitude
685	44.2180	-89.1132
686	44.2176	-89.1132
687	44.2173	-89.1132
688	44.2170	-89.1132
689	44.2166	-89.1132
690	44.2193	-89.1127
691	44.2189	-89.1127
692	44.2186	-89.1127
693	44.2183	-89.1127
694	44.2179	-89.1127
695	44.2176	-89.1127
696	44.2173	-89.1127
697	44.2169	-89.1127
698	44.2193	-89.1122
699	44.2189	-89.1122
700	44.2186	-89.1122
701	44.2183	-89.1122
702	44.2179	-89.1122
703	44.2176	-89.1122
704	44.2173	-89.1122
705	44.2189	-89.1117
706	44.2186	-89.1118
707	44.2183	-89.1118
708	44.2179	-89.1118
709	44.2193	-89.1113
710	44.2189	-89.1113
711	44.2186	-89.1113
712	44.2183	-89.1113
713	44.2179	-89.1113
714	44.2193	-89.1108
715	44.2189	-89.1108
716	44.2186	-89.1108
717	44.2183	-89.1108
718	44.2193	-89.1104
719	44.2189	-89.1104
720	44.2186	-89.1104
721	44.2183	-89.1104
722	44.2196	-89.1099
723	44.2193	-89.1099
724	44.2189	-89.1099
725	44.2186	-89.1099
726	44.2183	-89.1099
727	44.2196	-89.1094
728	44.2193	-89.1094
729	44.2189	-89.1094
730	44.2186	-89.1094
731	44.2196	-89.1090
732	44.2193	-89.1090
733	44.2189	-89.1090
734	44.2186	-89.1090
735	44.2196	-89.1085
736	44.2192	-89.1085
737	44.2189	-89.1085
738	44.2186	-89.1085
739	44.2192	-89.1080
740	44.2189	-89.1080
741	44.2186	-89.1080
742	44.2189	-89.1076
743	44.2186	-89.1076
744	44.2189	-89.1071
745	44.2186	-89.1071
746	44.2189	-89.1067
747	44.2186	-89.1067
748	44.2199	-89.1062
749	44.2196	-89.1062
750	44.2192	-89.1062
751	44.2189	-89.1062
752	44.2186	-89.1062
753	44.2199	-89.1057

Appendix B

- Aquatic plant survey data from August 28 & 29, 2008 for Long Lake near Saxeville, Waushara County, WI.

Aquatic plant species key:

CEDE	*Ceratophyllum demersum*	Coontail
CHAR	*Chara* spp.	Muskgrasses
ELCA	*Elodea canadensis*	Common waterweed
MYSI	*Myriophyllum sibericum*	Northern water-milfoil
NAFL	*Najas flexilis*	Bushy pondweed
NITE	*Nitella* spp	Nitella
NYOD	*Nymphaea odorata*	White water lily
POAM	*Potamogeton amplifolius*	Large-leaf pondweed
POFR	*Potamogeton friesii*	Frie's pondweed
POGR	*Potamogeton gramineus*	Variable pondweed
POIL	*Potamogeton illinoensis*	Illinois pondweed
PONA	*Potamogeton natans*	Floating-leaf
POPR	*Potamogeton praelongis*	White-stem pondweed
POPU	*Potamogeton pusillus*	Small pondweed
PORI	*Potamogeton richardsonii*	Clasping-leaf pondweed
PORO	*Potamogeton robbinsii*	Robbins pondweed
POZO	*Potamogeton zosteriformis*	Flat-stem pondweed
STPE	*Stuckenia pectinata*	Sogo pondweed
UTVU	*Utricularia vulgaris*	Common bladderwort
VAAM	*Vallisneria americana*	Wild celery

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
1		not navigable																				
2		not navigable																				
3		not navigable																				
4		not navigable																				
5		not navigable																				
6		not navigable																				
7	1.0			2		1																
8	0.5			2																		
9	1.0			2		1																
10	1.0			1																		
11		terrestrial																				
12		terrestrial																				
13	1.0			2					1													
14	2.0			2																		
15	2.0			1								1										
16	2.0			2																		
17	1.0			2					1													
18		terrestrial																				
19	2.0			1			1													1	1	1
20	3.0			3																3		
21	3.0			2						1					1		1					1
22	3.0			2			1													1		
23	1.0			3		1													1			
24	3.5			1																		
25	4.4			2								1	1									
26	3.7			2																		
27	3.3			2								1	1									
28		terrestrial																				
29	3.0			1																	1	
30		terrestrial																				
31	0.5			2			1		1											1		1
31	2.5			3											1							1
32	4.0			1									1							1		1
33	2.5			1																		
34	2.0			1			1													1		
35	1.0			2		1			1				1									
36	5.6			1						1			1									
37	8.0			2		1																
38	13.5			1								1			1							
39	11.5			1																		
40	3.0			1			1															
41	0.5			2							1					1				1		
42	2.7			1																		
43	3.2			1																		
44	2.5			1			1															
45		terrestrial																				
46	1.5			1			1															

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
47	4.0			2																		
48	8.1			1								1				1				2		
49	13.1			1																		
50	19.1			3																		
51	8.0			2								1								1		
52	3.9			1																		
53		terrestrial																				
54	0.3																					
55	2.5			1			1															
56	3.0			1			1															
57	2.7			1			1					1										
58	2.6			1																		
59	0.8			1																		
60		terrestrial																				
61	1.0			1			1													1		
62	5.6			1																		
63	9.6					1									1	1				1		
64	17.0			1																		
65	21.1	no plants																				
66	18.7			2																		
67	4.9			1								1										
68	2.5			1																		
69	0.5						1										1					
70		terrestrial																				
71		terrestrial																				
72	0.3																					
73	3.0			1																		1
74	3.8			1			1															
75	3.7			1			1															
76	3.6			1																		
77	2.7						1					1										
78	1.3			1								1										
79	1.5			1																		
80	3.0			1			1															1
81	5.4															1						
82	11.4			1																		
83	16.3			1		1																
84	20.4			3																		
85	20.0			1																		
86	18.9			2																		
87	10.0			1								1										1
88	2.8			1																		
89	2.5			1			1					1										
90	2.0			1																		
91	2.6																					
92	0.5			1																		
93	1.0	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
94	4.0			1			1					1										
95	5.1			1			1					1										
96	4.5			1																		
97	3.3			1			1															
98	2.7			3																		
99	2.1			1			1															
100		terrestrial																				
101	2.5			2																		
102	10.8			1			1					1								1		
103	14.4			1																		
104	19.0			2																		
105	20.3			1																		
106	26.2	no plants																				
107	22.1	no plants																				
108	14.8			1																		
109	3.0			1			1															
110	3.1			1			1															
111	3.1	sponge		1			1					1										
112	8.0			1								1										1
113	16.9	no plants																				
114	13.9			1																		
115	9.0			1		1							1							1		
116	13.5			1		1																
117	4.4			2								1										
118	4.9			1								1										
119	3.7			1			1															
120	3.2			1																		
121	2.8			1																		
122	2.5			1			1									1						
123	14.0			1																		
124	14.8			1																		
125	18.0			1																		
126	20.4			2																		
127	21.1			1																		
128	27.7			1																		
129	21.4	no plants																				
130	10.5			1								1	1							1		
131	5.3			2			1															
132	3.7			1			1					1										
133	8.0						1						1									1
134	22.9			1																		
135	21.9			1																		
136	19.0			1																		
137	20.0			1																		
138	16.4			3		1																
139	7.3			1									1							1		
140	5.4			1																		

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
141	3.6			1			1															
142	2.5	no plants																				
143	2.5			1			1															
144	8.8			3			1													1		
145	17.0	no plants																				
146	19.3			1																		
147	21.0			1																		
148	26.5	no plants																				
149	30.0	no plants																				
150	28.7	no plants																				
151	21.7			1																		
152	19.0			2																		
153	23.7	no plants																				
154	33.0	no plants																				
155	35.9	no plants																				
156	33.6	no plants																				
157	29.4	no plants																				
158	28.7	no plants																				
159	19.2			1																		
160	14.4			3																		
161	8.8																			1		
162	3.8			3								1										
163	3.0			1																		
164	1.0			1			1															
165	3.2			1																1		
166	6.9			1			1															
167	19.3			1																		
168	26.2	no plants																				
169	28.5	no plants																				
170	30.9	no plants																				
171	33.9	no plants																				
172	33.9	no plants																				
173	36.0	no plants																				
174	36.0	no plants																				
175	38.0	no plants																				
176	40.1	no plants																				
177	37.8	no plants																				
178	35.0	no plants																				
179	32.2	no plants																				
180	28.0	no plants																				
181	19.2			1																		
182	14.4			3		1																
183	7.0			2																		
184	3.0			1																		
185	1.0			1			1															
186	3.3																			1		
187	11.5			2			1					1								1		

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
188	24.0	no plants																				
189	30.3	no plants																				
190	35.7	no plants																				
191	38.8	no plants																				
192	41.6	no plants																				
193	42.0	no plants																				
194	47.7	no plants																				
195	50.1	no plants																				
196	52.0	no plants																				
197	52.8	no plants																				
198	48.4	no plants																				
199	40.7	no plants																				
200	33.0	no plants																				
201	22.6	no plants																				
202	19.6			2																		
203	18.2			2																		
204	6.1			1								1										
205	3.2			1								1										1
206	2.4			2																		
207	3.5			1			1															
208	11.2	no plants																				
209	27.0	no plants																				
210	30.5	no plants																				
211	36.4	no plants																				
212	39.9	no plants																				
213	40.0	no plants																				
214	43.4	no plants																				
215	49.0	no plants																				
216	52.9	no plants																				
217	55.0	no plants																				
218	55.1	no plants																				
219	52.1	no plants																				
220	42.0	no plants																				
221	34.5	no plants																				
222	28.1	no plants																				
223	22.1			3																		
224	20.3			3																		
225	14.8			3																		
226	3.4			1								1										
227	3.0	no plants																				
228	18.0			1																		
229	24.6	no plants																				
230	29.0	no plants																				
231	34.0	no plants																				
232	42.4	no plants																				
233	50.9	no plants																				
234	53.5	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
235	55.2	no plants																				
236	56.1	no plants																				
237	57.3	no plants																				
238	57.8	no plants																				
239	56.1	no plants																				
240	49.9	no plants																				
241	41.6	no plants																				
242	32.6	no plants																				
243	30.4	no plants																				
244	27.8	no plants																				
245	20.1			1																		
246	6.1			1								1	1									
247	4.0			1																		
248	2.4	no plants																				
249	3.8			1								1								1		
250	17.8	no plants																				
251	30.2	no plants																				
252	33.2	no plants																				
253	38.6	no plants																				
254	55.4	no plants																				
255	60.1	no plants																				
256	61.4	no plants																				
257	61.1	no plants																				
258	57.8	no plants																				
259	55.3	no plants																				
260	56.2	no plants																				
261	52.0	no plants																				
262	46.2	no plants																				
263	39.6	no plants																				
264	37.5	no plants																				
265	31.4	no plants																				
266	22.1			3																		
267	6.4			1								1										
268	4.0			1																		
269	0.3	no plants																				
270	1.5			1			1															
271	4.6			2			1															1
272	18.8	no plants																				
273	34.4	no plants																				
274	39.6	no plants																				
275	48.8	no plants																				
276	57.4	no plants																				
277	61.0	no plants																				
278	63.0	no plants																				
279	63.6	no plants																				
280	64.1	no plants																				
281	62.9	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
282	61.4	no plants																				
283	56.4	no plants																				
284	50.2	no plants																				
285	47.2	no plants																				
286	39.2	no plants																				
287	20.8			3																		
288	28.1	no plants																				
289	4.7			1								1								1		
290	3.2			2								1										1
291		no plants																				
292	3.8			1			1															
293	17.9			1																		
294	28.8	no plants																				
295	35.8	no plants																				
296	41.9	no plants																				
297	50.2	no plants																				
298	55.8	no plants																				
299	60.0	no plants																				
300	63.4	no plants																				
301	65.3	no plants																				
302	67.0	no plants																				
303	67.9	no plants																				
304	68.1	no plants																				
305	65.4	no plants																				
306	56.6	no plants																				
307	51.7	no plants																				
308	39.8	no plants																				
309	35.8	no plants																				
310	25.8	no plants																				
311	4.5			1																		
312	2.7	no plants																				
313	11.8			3			1															
314	28.8	no plants																				
315	33.0	no plants																				
316	39.4	no plants																				
317	49.0	no plants																				
318	53.1	no plants																				
319	56.2	no plants																				
320	60.8	no plants																				
321	64.8	no plants																				
322	68.1	no plants																				
323	70.1	no plants																				
324	71.0	no plants																				
325	71.6	no plants																				
326	67.8	no plants																				
327	60.4	no plants																				
328	51.2	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
329	38.0	no plants																				
330	11.3	no plants																				
331	4.9			1																		
332	2.0	no plants																				
333		no plants																				
334	3.6						1							1								
335	19.0										1	2										1
336	24.2	no plants																				
337	37.0	no plants																				
338	48.0	no plants																				
339	49.5	no plants																				
340	50.0	no plants																				
341	55.5	no plants																				
342	59.0	no plants																				
343	63.5	no plants																				
344	67.0	no plants																				
345	69.4	no plants																				
346	71.1	no plants																				
347	71.8	no plants																				
348	67.0	no plants																				
349	57.6	no plants																				
350	46.0	no plants																				
351	28.1	no plants																				
352	9.4			1			1					1										
353	2.8	no plants																				
354	4.2			1								1										1
355	24.8			1																		
356	35.4	no plants																				
357	38.0	no plants																				
358	44.8	no plants																				
359	50.8	no plants																				
360	52.5	no plants																				
361	53.1	no plants																				
362	55.9	no plants																				
363	59.0	no plants																				
364	64.0	no plants																				
365	67.4	no plants																				
366	69.0	no plants																				
367	70.3	no plants																				
368	65.0	no plants																				
369	55.2	no plants																				
370	44.6	no plants																				
371	31.5	no plants																				
372	7.9			1																		
373	2.6	no plants																				
374	3.6			1			1															
375	20.6			2																		

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
376	34.8	no plants																				
377	38.2	no plants																				
378	43.2	no plants																				
379	48.5	no plants																				
380	52.6	no plants																				
381	55.8	no plants																				
382	56.8	no plants																				
383	58.4	no plants																				
384	61.0	no plants																				
385	64.6	no plants																				
386	66.4	no plants																				
387	68.2	no plants																				
388	67.0	no plants																				
389	55.0	no plants																				
390	38.0	no plants																				
391	25.1	no plants																				
392	4.4	no plants																				
393	3.8	no plants																				
394	20.2			1																		
395	36.2	no plants																				
396	39.0	no plants																				
397	45.6	no plants																				
398	48.0	no plants																				
399	52.0	no plants																				
400	56.4	no plants																				
401	58.2	no plants																				
402	58.9	no plants																				
403	59.8	no plants																				
404	60.8	no plants																				
405	63.3	no plants																				
406	61.2	no plants																				
407	53.6	no plants																				
408	44.0	no plants																				
409	35.3	no plants																				
410	15.8			1								1										
411	3.1	no plants																				
412	29.0	no plants																				
413	38.0	no plants																				
414	42.0	no plants																				
415	44.9	no plants																				
416	47.0	no plants																				
417	55.0	no plants																				
418	58.0	no plants																				
419	59.0	no plants																				
420	58.8	no plants																				
421	56.2	no plants																				
422	57.6	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
423	57.5	no plants																				
424	53.5	no plants																				
425	48.7	no plants																				
426	36.0	no plants																				
427	22.0			2																		
428	4.3	no plants																				
429	30.0	no plants																				
430	38.5	no plants																				
432	36.0	no plants																				
432	38.0	no plants																				
433	36.9	no plants																				
434	53.0	no plants																				
435	57.1	no plants																				
436	56.7	no plants																				
437	49.9	no plants																				
438	51.4	no plants																				
439	55.2	no plants																				
440	52.0	no plants																				
441	43.0	no plants																				
442	32.0	no plants																				
443	7.4			1								1										
444	1.5	no plants																				
445	32.5	no plants																				
446	36.8	no plants																				
447	36.8	no plants																				
448	36.4	no plants																				
449	37.8	no plants																				
450	46.5	no plants																				
451	49.0	no plants																				
452	45.8	no plants																				
453	41.6	no plants																				
454	37.8	no plants																				
455	34.4	no plants																				
456	25.8			1																		
457	2.7	no plants																				
458	31.3	no plants																				
459	34.3	no plants																				
460	31.6	no plants																				
461	22.9	no plants																				
462	45.5	no plants																				
463	36.1	no plants																				
464	34.8	no plants																				
465	15.4			2																		
466	20.5			2																		
467	5.8	no plants												1								
468	5.0	no plants																				
469	29.4	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
470	24.9	no plants																				
471	16.1			1																		
472	31.8	no plants																				
473	33.5	no plants																				
474	27.5	no plants																				
475	11.9			1																		
476	3.7	no plants																				
477	8.3			1																		
478	17.5			2																		
479	13.4			1																		
480	29.9	no plants																				
481	33.2	no plants																				
482	28.8	no plants																				
483	11.1			1								1										
484	1.0	no plants																				
485	2.9	no plants																				
486	14.2			1																		
487	12.2			1																		
488	28.6	no plants																				
489	33.9	no plants																				
490	29.5	no plants																				
491	9.9			1																		
492	14.0			1		1																
493	16.5	no plants																				
494	25.5	no plants																				
495	35.1	no plants																				
496	30.7	no plants																				
498	8.3			1			1															
498	14.2			1								1										
499	13.0			1																		
500	16.6	no plants																				
501	34.1	no plants																				
502	30.5	no plants																				
503	6.6			1																		
504	9.5			1			1															
505	22.8	no plants																				
506	21.8			1																		
507	1.5			1																		
508	9.5												1	1								
509	20.1			1																		
510	22.5	no plants																				
511	7.9						1													1		1
512	17.3			3																		
513	27.9	no plants																				
514	8.1			1			1					1										
515	13.2			1			1				1	1										
516	28.1	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
519	9.3			1																		
520	13.3			2																		
521	25.9	no plants																				
522	19.0			1								1										
523	3.5			1																		
524		terrestrial																				
525		terrestrial																				
526	19.4			3																		
527	21.7	no plants																				
528	28.5	no plants																				
529	12.3			1																		
530		terrestrial																				
531	1.0			1																		
532	2.0					1						1	1						1	1		1
533	19.1			1																		
534	25.9	no plants																				
535	31.3	no plants																				
536	32.7	no plants																				
537	5.9			2								1										
538	2.0	no plants																				
539	2.6			1			1															
540	5.2			1																		
541	21.6			2																		
542	29.9	no plants																				
543	32.5	no plants																				
544	30.5	no plants																				
545	2.0			1																		
546		terrestrial																				
547		terrestrial																				
548	3.5			1			1					1										
549	5.8			1								1							1			1
550	21.1	no plants																				
551	28.1																					
552	33.0	no plants																				
553	32.9	no plants																				
554	19.6			1																		
555	3.2			1			1					1										
556	4.5			2																		
557	0.5			1			1															
558	0.5			1			1															
559	1.5			1																		
560	4.5			1			1					1										
561	10.7			1			1					1										
562	21.3	no plants																				
563	30.1	no plants																				
564	32.7	no plants																				
565	31.8	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
566	27.3	no plants																				
567	20.9			1																		
568	20.1			3																		
569	10.0			1								1								1		
570	1.0			2			1									1						
571	4.5			1																		1
572	7.4			1																		
573	4.3			1								1										
574	10.6			1									1									
575	29.9	no plants																				
576	32.2	no plants																				
577	33.9	no plants																				
578	35.5	no plants																				
579	34.5	no plants																				
580	30.8	no plants																				
581	26.7	no plants																				
582	19.5	no plants																				
583	8.1			3		1							1							1		
584	1.0			1				1														1
585	14.4	no plants																				
586	28.0	no plants																				
587	31.8	no plants																				
588	32.8	no plants																				
589	34.8	no plants																				
590	37.3	no plants																				
591	39.3	no plants																				
592	38.2	no plants																				
593	36.4	no plants																				
594	34.0	no plants																				
595	28.2	no plants																				
596	19.0			1																		
597	8.2			1		1																
598	1.5			1				1				1										
599	4.5			2								1										1
600	28.0	no plants																				
601	35.0	no plants																				
602	35.7	no plants																				
603	39.9	no plants																				
604	45.4	no plants																				
605	43.2	no plants																				
606	39.7	no plants																				
607	36.9	no plants																				
608	32.7	no plants																				
609	26.9	no plants																				
610	22.9	no plants																				
611	19.7			1																		
612	3.1			1																		

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
613	7.8			2			1					1										1
614	29.7	no plants																				
615	35.3	no plants																				
616	39.7	no plants																				
617	46.7	no plants																				
618	47.1	no plants																				
619	43.7	no plants																				
620	38.6	no plants																				
621	33.5	no plants																				
622	28.4	no plants																				
623	19.1			1																		
624	18.8			1																		
625	8.1			1			1					1										1
626	8.1			1																		
627	32.1	no plants																				
628	38.4	no plants																				
629	45.7	no plants																				
630	51.8	no plants																				
631	51.5	no plants																				
632	49.0	no plants																				
633	42.4	no plants																				
634	33.1	no plants																				
635	22.7	no plants																				
636	8.5			1								1										
637	5.3			1			1													1		1
638	18.5			1																		1
639	36.5	no plants																				
640	48.2	no plants																				
641	49.3	no plants																				
642	52.8	no plants																				
643	51.4	no plants																				
644	50.3	no plants																				
645	39.4	no plants																				
646	30.8	no plants																				
647	24.2	no plants																				
648	4.9			1														1				
649	30.9	no plants																				
650	45.6	no plants																				
651	51.9	no plants																				
652	52.4	no plants																				
653	51.4	no plants																				
654	50.8	no plants																				
655	46.6	no plants																				
656	38.1	no plants																				
657	31.1	no plants																				
658	16.4					1				1												
659	18.0			1																		

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
660	47.2	no plants																				
661	54.6	no plants																				
662	54.6	no plants																				
663	49.4	no plants																				
664	49.8	no plants																				
665	50.1	no plants																				
666	45.6	no plants																				
667	34.6	no plants																				
668	28.0	no plants																				
669	3.0	no plants																				
670	0.5	no plants																				
671	39.0	no plants																				
672	55.0	no plants																				
673	57.3	no plants																				
674	54.5	no plants																				
675	43.4	no plants																				
676	42.7	no plants																				
677	38.0	no plants																				
678	36.2	no plants																				
679	29.7	no plants																				
680	15.4			3		v	1		1													
681	20.2			3			1					1										
682	45.0	no plants																				
683	57.1	no plants																				
684	57.9	no plants																				
685	52.9	no plants																				
686	38.2	no plants																				
687	34.8	no plants																				
688	31.2	no plants																				
689	19.6	no plants																				
690	6.6			1								1	1									1
691	41.4	no plants																				
692	55.6	no plants																				
693	57.4	no plants																				
694	42.8	no plants																				
695	21.0	no plants																				
696	8.2			1								1										
697	6.5			1			1					1										
698	7.3			1								1										
699	36.4	no plants																				
700	48.2	no plants																				
701	48.4	no plants																				
702	33.3	no plants																				
703	7.5			1																		
704	4.3			1								1										
705	9.2			1																		
706	33.6	no plants																				

sampling point	Depth (ft)	comments	CEDE	CHAR	ELCA	MYSI	NAFL	NITE	NYOD	POAM	POFR	POGR	POIL	PONA	POPR	POPU	PORI	PORO	POZO	STPE	UTVU	VAAM
707	35.4	no plants																				
708	11.0			1			1					1										
709	3.4	no plants																				
710	15.4			1			1					1										
711	28.0	no plants																				
712	21.2	no plants																				
713	4.5											1										
714	4.6											1										
715	18.6											1										
716	25.5	no plants																				
717	19.4			3																		
718	19.1			1																		
719	20.0			3																		
720	20.1	no plants																				
721	5.9			1		1	1					1			1					1		1
722	5.3			1		1						1										1
723	18.7			1																		
724	19.4			1																		
725	16.3			2		1						1										
726	1.0			1		1	1		1													1
727	9.2			1								1										1
728	17.7			1																		
729	20.6			1																		
730	3.5			1																		
731	5.5			1								1										1
732	13.9			1		1																
733	15.9			1																		
734	2.0			1			1				1											
735	4.8			1			1					1										
736	7.5			2								1										
737	8.2			1		1										1						
738	1.5			1			1				1											
739	3.9			1								1										
740	6.7										1								1	1		1
741	0.5			1			1									1				1		
742	6.6				1	1					1	1							1	1		1
743	0.5			2			1		1							1						
744	2.9			1								1	1									1
745	1.0			1			1									1						
746	2.0			1							1					1						
747	0.5			1			1						1							1		
748		not navigable																				
749		not navigable																				
750		not navigable																				
751		not navigable																				
752		not navigable																				
753		not navigable																				

Appendix C

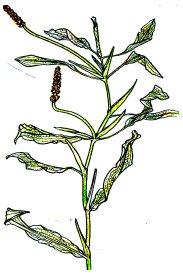
- The Importance of Aquatic Plants

The Importance of Aquatic Plants

Plant information was gathered from Borman et al. (1997), Eggers and Reed (1997), Fasset (1940), Fink (1994), Nichols and Vennie (1991), and Whitley et al. (1999). Images obtained from Schmidt and Kannenberg (1998) and Borman et al. (1997).

Musk grass (*Chara* spp.) is a complex algae that resembles a higher plant. It's identified by its pungent, skunk-like odor and whorls of toothed branched leaves. Ecologically, musk grass provides shelter for juvenile fish and is associated with black crappie spawning sites. Waterfowl love to feast on musk grass when the plant bears its seed-like oogonia. This species serves an important role in stabilizing bottom sediments, tying up nutrients in the water column, and maintaining water clarity.

Variable Pondweed (*Potamogeton gramineus*) and **Illinois Pondweed** (*P. illinoiensis*) are very similar-looking perennial herbs that emerge from a rhizome. Their stout stems support lance-shaped leaves that come to a sharp point. Both of these pondweeds provide excellent cover for fish and invertebrates. Ducks, geese, muskrats, and beaver find most parts of these plants to be a tasty meal.



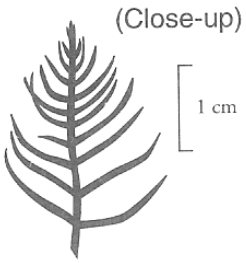
Bushy pondweed (*Najas flexilis*) also known as **slender naiad** has a finely branched stem that grows from a rootstock. Leaves are short (1-4 cm), pointed and grow in pairs. Bushy pondweed is an annual and must grow from seed each year. It tends to establish well in disturbed areas. Bushy pondweed is a one of waterfowl's favorite foods and considered very important. Waterfowl, marsh birds, and muskrats relish seeds, leaves and stems. Bushy pondweed stabilizes bottom sediment and offers cover for fish.

Wild Celery (*Vallisneria americana*) also known as **eelgrass** has long ribbon-like leaves that emerge in clusters. Leaves have a prominent central stripe and leaf tips tend to float gracefully at the water's surface. In the fall, a vegetative portion of the rhizome will break free and float to other locations. Wild celery is considered one of the best all natural waterfowl foods. The entire plant is relished by waterfowl, especially canvasbacks. Eelgrass beds serve as an important food source for sea ducks, marsh birds, and shore birds. Fish also find wild celery to be a popular hiding spot.

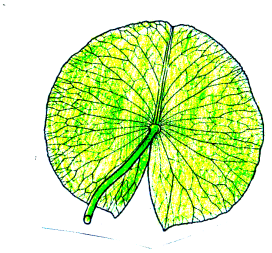
Sago Pondweed (*Potamogeton pectinatus*) is a perennial herb that emerges from a slender rhizome that contains many starchy tubers. Leaves are sharp, thin, and resemble a pine needle. Reddish nutlets (seeds) that resemble beads on a string rise to the water surface in mid-summer. Sago pondweed produces

a large crop of seeds and tubers that are valued by waterfowl. Juvenile fish and invertebrates utilize sago pondweed for cover.

Northern Watermilfoil (*Myriophyllum sibiricum*) produces whorls of feather-like leaflets from a fairly stout stem. Northern watermilfoil is identified by its 5 to 12 pairs of leaflets that become progressively longer near the base of the leaf – giving the leaf a candelabra-like appearance. The leaves and fruit of this plant are eaten by a variety of waterfowl. Its finely divided leaves are habitat for numerous invertebrates that fish feed upon. Northern watermilfoil is an indicator of good water quality, as the plant seldom survives in more eutrophic environments.



White Water Lily (*Nymphaea odorata*) emerges from a buried rhizome. Durable round stalks grow up from the rhizome. This perennial herb supports large round leaves (4-10 inches) wide that float at the water's surface. Leaves appear waxy green on top and reddish-purple on their undersides. At mid-summer showy white flowers float at the waters surface. Lilies serve as important fish cover, especially for largemouth bass. White water lily seeds are eaten by waterfowl. Rhizomes, flowers, and leaves are consumed by muskrats, beaver, and deer. With large broad leaves, lilies also help prevent shoreline erosion by slowing wave action.



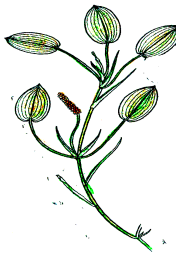
White-stem Pondweed (*Potamogeton praelongus*) has broad, wavy-edged leaves with stalkless leaf bases that wrap part way around the stem. The alternately arranged leaves have a distinctive boat-shaped tip. White-stem pondweed is often the first pondweed seen in early spring. No floating leaves are produced. White-stem pondweed provides good food and habitat for aquatic animals and waterfowl. It provides valuable food for trout and habitat for muskellunge in particular.

Flat-stem Pondweed (*Potamogeton zosteriformis*) emerges from a rhizome, which has strongly flattened stems. The leaves are narrow and grow 4-8 inches long. Leaves contain a prominent mid-vein and many fine parallel veins. Ecologically, flat-stem pondweed provides a home for fish and invertebrates, and is grazed by waterfowl and muskrats.

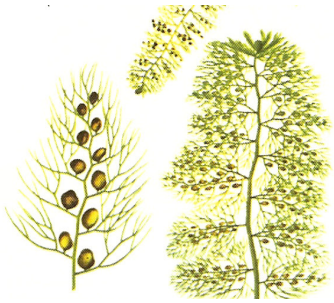
Large-Leaf Pondweed (*Potamogeton amplifolius*) also referred to by fisherman as **cabbage weed**, is a perennial herb that emerges from a ridged black rhizome. This pondweed is the largest of all pondweeds. The sturdy stem supports large broad leaves that are numerously veined (25-37). Growing upright throughout most of

the water column, large-leaf pondweed provides excellent shade, shelter, and foraging habitat for fish. Producing a large number of nutlets, cabbage weed is also valued by waterfowl.

Floating Leaf Pondweed (*Potamogeton natans*) is a perennial that emerges from a red-spotted rhizome. Leaves that rest at the waters surface are heart shaped. Submerged leaves tend to be longer and skinnier than floating leaves. Fish find this pondweed to be useful for foraging opportunities and shelter. Growing upright in the water column, floating leaf pondweed attracts many aquatic invertebrates. Muskrats, ducks, and geese all graze on the plant.



Bladderwort (*Utricularia vulgaris*) is a carnivorous plant that can supplement its diet with insects or other small organisms. Bladderwort does not root to the ground. Instead, it is free-floating. Usually most of the plant hangs in the water near the bottom, but it floats to the top when it is ready to flower. Bladderwort has finely divided leaves. Scattered on these leaves are bladders that trap prey. When prey touches trigger hairs, the bladder expands, sucking in the animal. It is then dissolved within the bladder. Bladderwort stems provide food and cover for fish. This is particularly important in areas not readily colonized by rooted plants.



Elodea (*Elodea canadensis*) or **common waterweed** is made up of slender stems with small, lance-shaped leaves that attach directly to the stem. Leaves are found in whorls of two or three and are more crowded toward the stem tip. The branching stems of elodea provide valuable cover for fish and are home for many insects that fish feed upon. Elodea also provides food for muskrats and waterfowl.

Robbins Pondweed (*Potamogeton robbinsii*) also known as **Fern Pondweed** is a stiff, robust plant that produces only underwater leaves. It is usually dark-green with flat closely spaced leaves pointing away from the stem on two sides, thereby giving it the appearance of a fern. Leaf bases form a sheath around the stems and may have stipules present on new leaves. Fern pondweed is also able to stabilize bottom sediments. Fern pondweed is known to provide habitat for small aquatic animals used as food by predator fishes, especially northern pike. Seeds and vegetation provide food for aquatic animals and waterfowl.

Appendix D

- Additional raw data for Long Lake Comprehensive Survey

Dissolved oxygen and temperature data from 2008 for the east basin of Long Lake, Waushara County, WI.

Depth	July 21, 2008			August 21, 2008			September 16, 2008		
(ft)	Temp (ºF)	D.O. (mg/l)	% Sat.	Temp (ºF)	D.O. (mg/l)	% Sat.	Temp (ºF)	D.O. (mg/l)	% Sat.
0	77.6	8.66	103.1	75.1	8.44	99.2	66.9	8.04	87.1
2	77.7	8.25	99.5	75.1	8.47	100.4	66.9	7.58	83.0
4	77.7	8.24	102.8	75.1	8.27	98.4	66.9	7.77	84.5
6	77.6	8.00	97.6	75.1	7.78	92.0	66.9	7.74	84.1
8	77.6	8.38	101.2	75.1	8.11	95.4	66.9	7.80	84.4
10	77.6	8.08	97.6	75.0	7.82	93.7	66.9	7.80	84.3
12	77.5	8.07	98.0	75.0	8.12	96.2	66.9	7.79	84.4
14	76.8	8.48	102.7	75.0	7.72	91.4	66.9	7.66	83.5
16	76.1	8.52	102.4	75.0	7.77	92.6	66.9	7.75	84.1
18	74.6	7.98	94.2	75.0	7.95	94.1	66.9	7.58	82.1
20	73.1	7.50	88.3	74.9	7.38	88.0	66.9	7.54	82.2
22	70.4	7.96	88.8	74.6	7.93	93.7	66.8	7.53	81.9
24	65.3	8.54	90.6	73.5	8.04	92.8	66.8	7.54	81.7
26	60.5	7.79	78.8	68.5	8.80	97.1	66.8	7.28	79.3
28	57.5	7.35	71.9	63.2	8.11	83.9	66.4	7.19	77.7
30	54.8	6.69	62.8	58.7	7.10	69.1	63.2	4.34	44.8
32	52.6	4.93	45.3	55.3	4.18	38.9	58.0	1.15	10.8
34	51.2	3.79	34.0	53.6	1.77	15.6	54.2	0.38	3.5
36	49.7	0.69	6.0	51.7	1.23	11.1	52.4	0.29	2.6
38	48.3	0.33	2.9	50.2	0.77	6.6	51.4	0.24	2.2
40	47.4	0.14	1.1	49.0	0.42	3.6	50.3	0.21	1.9
42	46.6	0.09	0.8	47.3	0.20	1.6	48.2	0.23	2.0
44	45.1	0.08	0.7	46.1	0.17	1.3	46.6	0.21	1.7
46	44.4	0.07	0.6	45.3	0.15	1.3	46.0	0.18	1.5
48	44.2	0.07	0.5	44.5	0.14	1.1	45.6	0.16	1.3
50	43.9	0.07	0.5	44.1	0.11	1.0	45.7	0.14	1.1

Dissolved oxygen and temperature data from 2008 for the west basin of Long Lake, Waushara County, WI.

Depth	July 21, 2008			August 21, 2008			September 16, 2008		
(ft)	Temp (ºF)	D.O. (mg/l)	% Sat.	Temp (ºF)	D.O. (mg/l)	% Sat.	Temp (ºF)	D.O. (mg/l)	% Sat.
0	77.4	8.54	103.5	75.6	8.65	103.0	66.7	8.39	90.9
2	77.5	8.33	101.2	75.5	8.32	99	66.8	8.30	90.0
4	77.5	8.26	100.4	75.5	8.31	99	66.8	8.26	89.6
6	77.5	8.55	104.0	75.4	8.36	100	66.8	8.22	89.1
8	77.5	8.45	102.7	75.4	8.37	99	66.8	8.17	88.6
10	77.5	8.41	102.3	75.4	8.30	99.8	66.8	8.20	89.0
12	77.3	8.46	102.8	75.4	8.29	98.7	66.8	8.16	88.5
14	77.3	8.46	102.2	75.3	8.32	98.8	66.8	8.11	87.5
16	76.8	8.67	104.6	75.3	8.32	98.9	66.7	7.94	86.4
18	75.8	8.66	103.1	75.3	8.32	98.7	66.7	8.04	87.2
20	74.3	7.69	88.3	75.1	8.18	97.1	66.7	7.81	84.3
22	71.1	8.53	97.0	75.0	8.18	96.9	66.7	7.84	84.4
24	65.8	9.47	102.1	73.3	8.45	98.4	66.7	8.06	87.2
26	62.2	9.61	98.4	67.8	8.16	100.5	66.6	8.05	87.2
28	58.4	8.96	87.8	64.5	8.81	93.3	66.4	7.85	84.9
30	56.6	8.66	83.4	60.2	8.51	85.4	64.0	6.07	63.2
32	53.3	9.02	82.8	55.8	8.22	77.9	57.5	5.25	51.1
34	50.4	4.01	38.8	53.7	6.17	58	54.9	3.53	33.0
36	48.8	2.64	23.1	52.7	4.91	44	50.8	0.89	7.4
38	47.4	1.23	10.3	50.2	3.35	29.2	48.9	0.52	4.4
40	46.2	0.70	5.9	48.5	1.74	14.8	47.5	0.25	2.0
42	45.3	0.30	2.9	47.7	1.00	8.3	47.0	0.19	1.5
44	44.3	0.16	1.2	46.0	0.57	4.2	45.9	0.15	1.2
46	43.7	0.11	0.9	45.8	0.46	3.7	45.9	0.12	1.0
48	42.6	0.09	0.7	44.8	0.28	2.3	45.9	0.11	0.8
50	42.1	0.09	0.6	43.3	0.14	1.1	45.8	0.08	0.7

Historic fishery stocking data for Long Lake, Waushara County, WI.

Year	Species	Age Class	Number stocked	Avg Fish Length (in)	Source Type
1972	Walleye	Fingerling	12,000	3	DNR coop ponds
1972	Walleye	Yearling	2,120	11	Federal hatchery
1973	Walleye	Yearling	600	9	Federal hatchery
1974	Smallmouth bass	Fingerling	5,000	3	Private hatchery
1975	Smallmouth bass	Fingerling	10,000	3	DNR coop ponds
1975	Walleye	Adult	100	--	Federal hatchery
1976	Smallmouth bass	Yearling	3,600	--	--
1981	Northen pike	Yearling	218	--	Field transfer
1982	Northen pike	Fingerling	1,150	9	DNR coop ponds
1982	Northen pike	Yearling	1,070	--	Field transfer
1982	Walleye	Yearling	18	--	Field transfer
1983	Northen pike	Fingerling	1,350	9	DNR hatchery
1984	Largemouth bass	Fingerling	800	4	Field transfer
1984	Northen pike	Fingerling	1,060	9	DNR hatchery
1984	Walleye	Fingerling	2,300	4	Field transfer
1985	Northen pike	Fingerling	1,375	9	DNR hatchery
1987	Largemouth bass	Fingerling	3,600	6	Field transfer
1987	Northen pike	Fingerling	1,500	9	DNR hatchery
1987	Walleye	Fingerling	36,000	5	DNR hatchery
1991	Muskellunge	Fingerling	502	10	DNR hatchery
1991	Walleye	Fingerling	4,350	5	DNR coop ponds
1992	Muskellunge	Yearling	154	18	DNR hatchery
1992	Walleye	Fingerling	6,902	3	DNR coop ponds
1994	Walleye	Large fingerling	500	8	Private hatchery
1997	Muskellunge	Yearling	23	19	DNR ponds
1997	Walleye	Large fingerling	10,000	3	DNR ponds
1998	Walleye	Small fingerling	6,421	1	DNR hatchery
1999	Walleye	Small fingerling	6,800	2	DNR hatchery
1999	Walleye	Large fingerling	3,000	7	Private hatchery
1999	White sucker	Adult (broodstock)	1,284	9	Field transfer
1999	White sucker	Adult (broodstock)	1,500	8	Private hatchery
2000	Black crappie	Large fingerling	2,500	5	Private hatchery
2000	Walleye	Large fingerling	2,400	7	Private hatchery
2000	Walleye	Small fingerling	27,000	2	DNR hatchery
2000	White sucker	Adult	1,500	7	Private hatchery
2000	Yellow perch	Adult (field transfer)	3,750	5	Field transfer
2000	Yellow perch	Yearling	2,000	4	Field transfer
2001	Fathead minnow	Adult (broodstock)	--	--	Private hatchery
2001	Largemouth bass	Large fingerling	2,250	1	DNR ponds
2001	Northen pike	Adult (broodstock)	--	17	Private hatchery
2001	Walleye	Large fingerling	--	8	Private hatchery
2001	Walleye	Small fingerling	27,200	2	DNR ponds
2001	White sucker	Adult (broodstock)	--	10	Private hatchery
2002	Fathead minnow	Adult (broodstock)	10,000	2	Private hatchery
2002	White sucker	Yearling	1,500	5	Private hatchery

Historic fishery stocking data for Long Lake, Waushara County, WI.

Year	Species	Age Class	Number stocked	Avg Fish Length (in)	Source Type
2003	Black crappie	Fall yearling	1,875	--	Private hatchery
2003	Northen pike	Large fingerling	125	--	Private hatchery
2003	Walleye	Small fingerling	27,196	2	DNR hatchery
2003	Walleye	Fall yearling	3,000	--	Private hatchery
2003	White sucker	Fall yearling	250	--	Private hatchery
2003	Yellow perch	Adult (broodstock)	1,000	--	Private hatchery
2004	Black crappie	Fall yearling	800	4	Private hatchery
2004	Black crappie	Unknown	200	7	Private hatchery
2004	White sucker	Adult (field transfer)	1,385	19	Field transfer
2005	Fathead minnow	Adult	80,000	--	Private hatchery
2005	Walleye	Large fingerling	1,000	7	Private hatchery
2005	Walleye	Small fingerling	27,996	2	DNR ponds
2005	White sucker	Adult (field transfer)	1,170	20	Field transfer
2006	Brook trout	Adult (broodstock)	250	13	Private hatchery
2006	Fathead minnow	Adult	160,000	--	Private hatchery
2006	White sucker	Adult (field transfer)	1,175	24	Field transfer
2007	Black crappie	Adult	1,000	7	Private hatchery
2007	Brown trout	Large fingerling	5,575	6	DNR hatchery
2007	Fathead minnow	Yearling	80,000	--	Private hatchery
2007	Rainbow Trout	Adult	2,000	11	Private hatchery
2007	Walleye	Small fingerling	16,465	2	DNR hatchery
2007	Walleye	Yearling	2,000	7	Private hatchery
2008	Brown trout	Large fingerling	9,997	6	DNR hatchery
2008	Fathead minnow	Adult	80,000	2	Private hatchery
2008	Rainbow Trout	Adult	2,000	10	Private hatchery

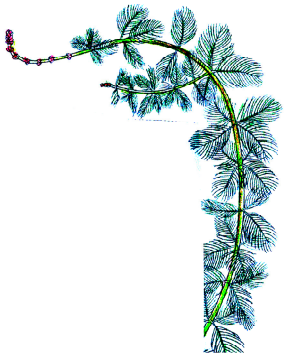
Appendix E

- Threat of exotic aquatic species to Long Lake

Exotic Species

Although no exotic species were found within the waters of Long Lake, it is important that members of the Long Lake Association familiarize themselves with some of the possible threats posed by invasive species. The following descriptions are given to promote awareness of exotic species.

Eurasian Watermilfoil



Eurasian watermilfoil (*Myriophyllum spicatum*) produces long spaghetti-like stems that often grow up to the water's surface. Leaves are feather-like and resemble bones on a fish. 3-5 leaves are arranged in whorls around the stem, and each leaf contains 12-21 pairs of leaflets. At mid-summer small reddish flower spikes may emerge above the water's surface. Perhaps the most distinguishing characteristic though, is the plant's ability to form dense, impenetrable beds that inhibit boating, swimming, fishing, and hunting.

Eurasian watermilfoil is native to Europe, Asia and Northern Africa. Of the eight milfoil (*Myriophyllum*) species found in Wisconsin, Eurasian watermilfoil is the only exotic. The plant was first introduced into U.S. waters in 1940. By 1960, it had reached Wisconsin's lakes. Since then, its expansion has been exponential (Brakken, 2000).

Eurasian watermilfoil begins growing earlier than native plants, giving it a competitive advantage. The dense surface mats formed by the plant block sunlight and have been found to displace nearly all native submergent plants. Over 200 studies link declines in native plants with increases in Eurasian watermilfoil (Madsen, 2001). The resultant loss of plant diversity degrades fishery habitat (Pullman, 1993), and reduces foraging opportunities for waterfowl and aquatic mammals. Eurasian watermilfoil has been found to reduce predatory success of fish such as largemouth bass (Engel, 1985), and spawning success for trout (*Salmonidae spp.*) (Newroth, 1985).

The continued spread of Eurasian watermilfoil can produce significant economic consequences. In the Truckee River Watershed below Lake Tahoe, located in western Nevada and northeastern California, economic damages caused by Eurasian watermilfoil to the recreation industry have been projected at $30 to $45 million annually (Eiswerth et al., 2003). In Tennessee Valley Authority Reservoirs, Eurasian watermilfoil was found to depress real estate values, stop recreational activities, clog municipal and industrial water intakes and increase mosquito breeding (Smith, 1971).

Eurasian watermilfoil has been found to reduce water quality in lakes by several means. Dense mats of Eurasian watermilfoil have been found to alter temperature and oxygen profiles – producing anoxic conditions in bottom water layers (Unmuth et al., 2000).

These anoxic conditions can cause localized die-offs of mollusks and other invertebrates. Eurasian watermilfoil has also been found to increase phosphorus concentration in lakes through accelerated internal nutrient cycling (Smith and Adams, 1986). Increased phosphorus concentrations released by dead and dying Eurasian watermilfoil have been linked to algae blooms and reduced water clarity.

Eurasian Watermilfoil Management Options

Historically, management of Eurasian watermilfoil has included mechanical, biological, and chemical means. It is important to consider each of these control measures before management efforts on any water body are undertaken. After weighing the pros and cons of each option, the wisest course of action should be chosen.

Hand pulling
Hand pulling of Eurasian watermilfoil is a useful tool when the extent of milfoil occurs at very low frequencies. For this method to be successful care must be taken to remove the entire root mass along with the plant or else it will quickly regenerate. If a pioneering population of Eurasian watermilfoil was found in a small location, this method may be a useful management tool. However, if it is unsuccessful at reducing or eliminating milfoil, other management options should be considered. This is still a viable option for riparian property owners. Without obtaining a permit, individuals can hand pull aquatic plants in a 30-foot strip along their property extending out as far as necessary. If *exotic* plants are singled out for hand removal, there are no restrictions on the extent of hand-pulling. If large amounts of milfoil are present, it will be labor intensive. If individuals choose to hand pull, care should be taken to properly identify Eurasian watermilfoil and minimize its fragmentation.

Mechanical harvesting
Mechanical control methods include hand cutters and boat-mounted mechanical weed harvesters (Nichols, 1974). While these methods provide temporary nuisance relief, they are rarely recommended as control methods for Eurasian watermilfoil. Eurasian watermilfoil can reproduce effectively through fragmentation (Borman et al. 1997). Free-floating plant matter left from cutting operations can spread quickly and encourage additional infestations within the lake or in neighboring lakes. Because a harvesting program is already in place on the Flowage, care should be taken if Eurasian watermilfoil is found in the near future. If possible, harvesting in areas of infestation should be suspended until additional control efforts are implemented to remove the milfoil. Although harvesting does remove plant matter, a source of nutrients to the lake, it is unlikely that harvesting will induce a shift back to a native plant-dominated community if milfoil were to be introduced to the Flowage. It is not recommended that Eurasian watermilfoil be controlled long-term through mechanical harvesting.

Milfoil weevils
There has been considerable research on biological vectors, such as insects, and their ability to affect a decline in Eurasian watermilfoil populations. Of these, the milfoil

weevil (*Euhrychiopsis lecontei*) has received the most attention. Native milfoil weevil populations have been associated with declines in Eurasian watermilfoil in natural lakes in Vermont (Creed and Sheldon, 1995), New York (Johnson et al., 2000) and Wisconsin (Lilie, 2000). While numerous lakes have attempted stocking milfoil weevils in hopes of controlling milfoil in a more natural manner, this method has not proven successful in Wisconsin. A twelve-lake study called "The Wisconsin Milfoil Weevil Project" (Jester et al. 1999) conducted by the University of Wisconsin, Stevens Point in conjunction with the Wisconsin DNR researched the efficacy of weevil stocking. This report concluded that milfoil weevil densities were not elevated, and that Eurasian watermilfoil was unaffected by weevil stocking in any of the study lakes. Recently, however, work carried out on a number of Portage County lakes has shown some promise at enhancing milfoil weevil populations. In order for weevils to be successful in reducing the extent of Eurasian watermilfoil, a number of environmental criteria are needed, including the availability of proper year-round habitat. In the event of milfoil infestation, a survey of existing weevils should be conducted to determine the likelihood of success if weevils were chosen as a management tool.

Until more evidence that suggests weevil stocking is an effective control agent for Eurasian watermilfoil, this method should be discouraged as a control option for most lakes.

Herbicides

Herbicides have been the most widely used and often most successful tools for controlling Eurasian watermilfoil. The two herbicide groups most commonly employed are fluridone (Avast®, Sonar®) and 2,4-D (Aquacide®, Aquakleen®, Navigate®, and Weedar 64®). Whole-lake fluridone treatments have been conducted on several Wisconsin Lakes. In addition, for fluridone to be most effective, a relatively long contact time is needed. 2,4-D herbicides, on the other hand, have been very effective at controlling Eurasian watermilfoil in hundreds of Wisconsin lakes. 2,4-D is a herbicide which rapidly breaks down and does not persist in the environment. When applied at labeled rates, 2,4-D has been shown to be an effective tool at selectively controlling Eurasian watermilfoil.

Curly-leaf Pondweed

Curly-leaf pondweed (*Potamogeton crispus*) has oblong leaves that are 2-4 inches long and attach to a slightly flattened stem in an alternate pattern. The most distinguishing characteristics are the curled appearance of the leaves, and the serrated leaf edges. Curly-leaf pondweed also produces a seed-like turion, which resembles a miniature pinecone. Curly-leaf pondweed produces turions in early summer allowing the plant to regenerate annually. Turion production begins when water temperatures reach into the 60's.

This exotic pondweed is a cold-water specialist. Curly-leaf pondweed can begin growing under the ice, giving it a competitive advantage over native plants, which are still lying dormant. By mid-summer when water temperatures reach the upper 70° F range, it begins to die off.

Curly-leaf pondweed has been found in the U.S. since at least 1910. A native of Europe, Asia, Africa and Australia, this plant is now found throughout much of U.S. (Baumann et al., 2000).

As with Eurasian watermilfoil, curly-leaf pondweeds aggressive early season growth allows it to out compete native species and grow to nuisance levels. Because the plant dies back during the peak of the growing season for other plants though, it is better able to coexist with native species than Eurasian watermilfoil. Perhaps the most significant problem associated with curly-leaf pondweed involves internal nutrient cycling. The die-off and decomposition of the plant during the warmest time of year often leads to a sudden nutrient release in the water. This often leads to nuisance algae blooms and poor water quality.

Curly-leaf Pondweed Management Options

Curly-leaf pondweed has primarily been managed through mechanical and chemical means. If curly-leaf pondweed were to be introduced, the following control options should be considered to determine the best course of action.

Hand pulling

As with Eurasian watermilfoil, this method may be appropriate for riparian property owners. Hand pulling is most effective when curly-leaf pondweed is discovered in its pioneering stage. If it has existed long enough to produce turions, hand pulling may become a long-term, labor-intensive process. To be most effective, as with other curly-leaf pondweed control options, early response is recommended. .

Mechanical harvesting and cutting
Both mechanical harvesting and hand cutting are commonly used to control curly-leaf pondweed. Cutting the plant provides temporary nuisance relief and may increase recreational opportunities on the lake. And although harvesting may not encourage dispersal of the plant, as it does with Eurasian watermilfoil, it is unlikely to provide any long-term control.

Herbicides
The herbicide most often used to control curly-leaf pondweed is Aquathol®. Aquathol® is an endothall salt-based herbicide which also rapidly breaks down. While endothall herbicides are effective on a broad range of aquatic monocots, early season applications made at low rates are highly species-selective for curly-leaf pondweed. While herbicides effectively kill the parent plant, the turions are resistant to herbicides, allowing curly-leaf pondweed to regenerate annually.

Studies conducted by the Army Corps of Engineers have found that conducting treatments of curly-leaf pondweed using Aquathol® when water temperatures are in the 50-60° F range will kill plants before turions form, thus providing long-term control. Researchers found that conducting two or more treatments over consecutive seasons for established curly-leaf pondweed populations will target both the standing crop of the pondweed as well as the resulting regrowth from the turions (Skogerboe and Poovey, 2002). These findings make Aquathol® the tool of choice for controlling curly-leaf pondweed in the lakes of Wisconsin.

Purple Loosestrife

Purple loosestrife (*Lythrum salicaria*) forms bright purple flowers in a spike atop stems that reach 2 to 7 feet in height. Lance-shaped leaves are arranged oppositely along the stem. Purple loosestrife can be found in a wide variety of habitats from shallow water to moist soils. Like Eurasian watermilfoil it is a very aggressive plant that can displace many native wetland plants including cattails (*Typha spp.*). Purple loosestrife plants produce hundreds of thousands of tiny seeds. When purple loosestrife is cut, seeds stick to mowing equipment and are spread to new locations. This invasive plant causes significant economic damage by clogging waterways and irrigation canals. Unlike cattails, purple loosestrife has little food or cover value for wildlife (Borman et. al. 1997).

Purple Loosestrife Management Options

Only one small patch of purple loosestrife was found growing along McCaslin Creek. Although it had not become a large nuisance, the Association and individual property owners should still be aware of control options to stop the spread of this exotic in the State. There are several methods that are commonly used for purple loosestrife control including digging or hand pulling, cutting, herbicide treatments and biological controls.

Manual removal

Digging and hand pulling are most effective for small infestations. Individual property owners are encouraged to use this method if they are able. Cutting involves removal and destruction of flowers and seed heads to inhibit plant propagation. Since cut plants tend to re-grow and since seeds present in the soils can sprout new plants, this method may need to be done for a number of years before desired control is achieved.

Herbicides

Herbicide treatments are the least labor intensive of methods. The preferred herbicide is glyphosate (Eagre®, Rodeo®). This compound rapidly biodegrades upon contact with soil or water. As a result, there are no water use restrictions following treatment. Because it is non-selective, each individual plant must be sprayed, as opposed to broadcast applications. Glyphosate is extremely effective in controlling purple loosestrife at a very low cost of treatment. The biggest disadvantage is that seeds in the soil will sprout new

plants, requiring annual treatments for a number of years before desired control is achieved. A DNR permit is required for treatment; however the fee is waived. This option should be considered if the distribution of purple loosestrife increases significantly.

Loosestrife beetles

Two species of leaf-eating beetles (*Galerucella calmariensis* and *G. pusilla*) are currently available from the Wisconsin DNR in an effort to control purple loosestrife by biological means. Research has shown that these insects are almost exclusively dependent upon purple loosestrife and do not threaten native plants. Although, as with most biological control agents, these insects will not eradicate loosestrife, but may significantly weaken the population and allow native species to reclaim infested areas. According to the WDNR, tests have shown significant declines in loosestrife as a result of biological control. The District should consider using biological control for loosestrife. The purple loosestrife control program established through the DNR provides a parent stock of beetles to individuals who are willing to raise the insects in a controlled environment until they are able to reproduce. Once the young have matured, they are released and are able to begin control of the purple loosestrife. As with other exotic plant control project, annual monitoring should be employed to assess the success of control measures. If significant progress is not made, alternative management options can be considered to control purple loosestrife.

Zebra Mussels

Zebra mussels (*Dreissena polymorpha*) are small (1/4" to 2") mollusks with elongated shells marked by alternating light and dark markings. They produce dense elastic strands, called byssal threads, by which they can securely attach to nearly any surface, often forming barnacle-like incrustations. Mussels spawn in the early spring when water temperatures reach 54º F. Fertilized eggs develop into microscopic free-swimming larvae called veligers. After three to four weeks, the surviving veligers settle onto firm objects where they quickly attach themselves. Within a year the young grow into adults that can live four to six years.

Zebra mussels were introduced to the Great Lakes region in the late 1980s through discharged ballast water of ships traveling the Saint Lawrence Seaway. These ships originated from European ports. Zebra mussels are native to the Ukraine and Russia near the Black and Caspian Seas. Since the 1700s zebra mussels have spread throughout European river systems.

Although zebra mussels do not cause much harm to the surrounding environment, they can negatively impact recreation and business by clogging water intake pipes, encrust boat hulls and piers, and wash up on beaches.

Zebra Mussel Management Options

Currently there is no lake-wide control option that isn't deadly to other aquatic life forms. In some areas of Europe and Lake Erie large populations of diving ducks have been shown to significantly decrease the population of zebra mussels each year. However, given the zebra mussel's high reproductive capacity, populations are able to recover each summer. In addition, diving duck populations in the Great Lakes region are low since they are only prevalent in the region during winter and summer migrations.

A number of fish species have been known to feed on zebra mussels. These include the freshwater drum, round goby, yellow perch, catfish, and carp. Certain fish species will feed on the adults while others eat the free-swimming juveniles. Although fish predation occurs, it is not significant enough to significantly decrease zebra mussel populations.

In recent years scientists have noted that native freshwater sponges in Lake Michigan appear to be increasing in number and attaching themselves to zebra mussels. In doing so, the sponges can kill the zebra mussels by cutting off the mussel's food and water supply.

Some success has been achieved by manually removing mussels from a lake. Although this method can dramatically reduce populations, it does not eradicate the mussels. In addition, it should be noted that this option is also very labor intensive.
Earlier this year a quarry in Virginia was able to eradicate zebra mussels from its waters. This was accomplished by applying a solution of potassium chloride over a three-week period in January. At the rate the solution was applied, it did not pose a risk to the environment or humans. This option would be most effective in small contained systems where cost does not prohibit control efforts.

Current research is focused on studying the environmental cues and physiological pathways that coordinate zebra mussel spawning. If the timing of male and female spawning can be disrupted, the numbers of fertilized eggs would be greatly reduced.